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10/537,821	12/16/2005	Brian David Sowerby		7184

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EXAMINER	
MIDKIFF, ANASTASIA	
ART UNIT	**PAPER NUMBER**
2882	

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Please find below and/or attached an Office communication concerning this application or proceeding.

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Office Action Summary	Application No.	Applicant(s)
	10/537,821	SOWERBY ET AL.
	Examiner	Art Unit
	Anastasia Midkiff	2882

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *16 December 2005*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-27* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-27* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *16 December 2005* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date *12/16/05*. + 6/9/05

4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

Specification

The disclosure is objected to because of the following informalities: The specification refers to color drawings to illustrate the invention, but the drawings submitted are in black-and-white. Either the specification should be amended to refer to black-and-white drawings, or color drawings should be submitted. If color drawings are submitted, it should be noted that color photographs and color drawings are not accepted unless a petition filed under 37 CFR 1.84(a)(2) is granted.

Appropriate correction is required.

Drawings

The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they include the following reference character(s) not mentioned in the description: "38," used to designate a collimating slit in Line 27 of Page 12.

The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the collimating block with collimating slots, fan-shaped beams, detector collimator, computing means, and display means of Claims 1-27, the second neutron source of Claims 8-10, the crossed wavelength shifting fibers of Claim 12, the different colored pixels of Claims 13-14 and 16-21, the multiple sets of detectors of Claim 24, and the mask and reflective surface of Claim 27 must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

Corrected drawing sheets in compliance with 37 CFR 1.121(d), or amendment to the specification to add the reference character(s) in the description in compliance with 37 CFR 1.121(b) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

The listing of references in the specification on Pages 22-23 is not a proper information disclosure statement. 37 CFR 1.98(b) requires a list of all patents, publications, or other information submitted for consideration by the Office, and MPEP § 609.04(a) states, "the list may not be incorporated into the specification but must be submitted in a separate paper." Therefore, unless the references have been cited by the examiner on form PTO-892, they have not been considered.

Claim Objections

Claims 1-27 are objected to because of the following informalities:

With respect to Claim 1, Line 7 recites, “X-ray and gamma ray sources,” wherein there is a lack of antecedent basis for this limitation. Examiner suggests replacing “the neutron and X-ray and gamma ray sources” with --the neutron source and the X-ray or gamma ray source--.

With respect to Claim 2, in Line 2 replace, “137Cs, 60Co,” with --^{137}Cs, ^{60}Co-- for clarity.

With respect to Claim 4, in Line 6 replace “the gamma-rays” with --the X-rays or gamma rays,” for the sake of consistency and clarity.

With respect to Claim 13, Line 5 recites, “the second neutron source,” wherein there is a lack of antecedent basis for this limitation. Examiner suggests replacing “the” with --a--. Additionally, the claim is narrative in form and contains indefinite and functional or operational language, *i.e.,* “are used to infer” in Line 2. The structure which goes to make up the device must be clearly and positively specified. The structure must be organized and correlated in such a manner as to present a complete operative device.

With respect to Claim 14, the claim is narrative in form and contains indefinite and functional or operational language, *i.e.,* “the transmissions are used to” in Lines 1-2. The structure which goes to make up the device must be clearly and positively specified. The structure must be organized and correlated in such a manner as to present a complete operative device.

With respect to Claim 22, Lines 2-3, and Claim 23, Line 2, the claims recite, "the transport mechanism," wherein there is a lack of antecedent basis for this limitation. Examiner suggests replacing "the" with --a--.

With respect to Claim 23, insert the term --on-- between "synchronicity" and "either" in Line 3.

Claim 14 is objected to based on its dependency upon Claim 13.

Claims 3-12 and 15-27 are objected to based on their dependency upon Claim 1.

Appropriate correction is required.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 1-27 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

In Claim 1, at Line 3, the limitation "or similar" renders the claim indefinite because it is unclear what structure is or is not covered by the limitation. See MPEP § 2173.05(b).

In Claim 2, at Line 2, the limitation "or similar" renders the claim indefinite because it is unclear what structure is or is not covered by the limitation. See MPEP § 2173.05(b).

With respect to Claims 4-6, Lines 4, 2, and 2, respectively, the phrase, “sources…are arranged to pass through the same slot,” render the claims indefinite as it is unclear how the sources are to pass through the slot in the collimating block.

In Claim 8, at Line 2, the limitation "or similar" renders the claim indefinite because it is unclear what structure is or is not covered by the limitation. See MPEP § 2173.05(b). Additionally, Line 4 recites, “the first source,” wherein there is insufficient antecedent basis for this limitation.

With respect to Claim 10, Line 2 recites, “second source,” wherein there is insufficient antecedent basis for this limitation.

With respect to Claim 13, Line 4 recites, “the first source,” and line 5 recites, “the second source,” wherein there is insufficient antecedent basis for these limitations.

With respect to Claim 14, the claim is narrative in form and replete with indefinite and functional or operational language, *i.e.,* “the transmissions are used to” in Lines 1-2. The structure which goes to make up the device must be clearly and positively specified. The structure must be organized and correlated in such a manner as to present a complete operative device.

With respect to Claims 22 and 23, Lines 2-3 and 2, respectively, the claims recite, “the transport mechanism,” wherein there is insufficient antecedent basis for these limitations.

With respect to Claim 26, the phrase "or as high as practically possible" in Line 3 is a relative term which renders the claim indefinite. The phrase “as high as practically possible” is not defined by the claim, the specification does not provide a standard for

ascertaining the requisite degree, and one of ordinary skill in the art would not be reasonably apprised of the scope of the invention. Additionally, the Examiner notes that the phrase "1010 neutrons/second" is not consistent with a "high" range as known in the art.

Claims 3, 7, 9, 11, 12, 15-21, 24, 25, and 27 are rejected based on their dependency on Claim 1.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

Claims 1-4, 11, 13, 15, 17, 18, 20, 22, 24, and 26, as they are best understood, are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent to Bartle (USP# 5,479,023).

With respect to Claim 1, Bartle teaches radiographic equipment comprising: a source (6) of substantially mono-energetic fast neutrons produced via the deuterium-tritium or deuterium-deuterium fusion reactions (Column 2 Lines 30-31, and Column 5 Lines 64-67), comprising a sealed-tube or similar generator for producing the neutrons (Column 5, Lines 64-67); a source (6) of gamma rays (Column 5, Lines 3-5) of sufficient energy to substantially penetrate an object to be imaged (Column 2, Lines 25-36); a collimating block surrounding the neutron and gamma ray sources, apart from the

provision of one or more slots for emitting substantially fan-shaped radiation beams, as known for the types of sources/systems listed (Column 2 Lines 61-64, and Column 3 Lines 17-40); a detector array (5) aligned with the fan-shaped beams emitted from the source collimator (Figure 2) and collimated to substantially prevent radiation other than directly transmitted from the sources reaching the array (Figure 2 and Column 5 Lines 31-43); conversion means (21) for converting light pulses produced in the scintillators into electrical signals (Column 5, Lines 34-39); conveying means (15) for conveying the object between the sources and the detector array (Figure 2); computing means (25) for determining from the electrical signals the attenuation of the neutrons and the X-ray or gamma ray beams (Column 5, Lines 15-19) and to generate output representing the mass distribution and composition of the object interposed between the sources and detector array (Column 3, Lines 16-26); and display means (30) for displaying images based on the mass distribution and the composition of the object being scanned (Column 3, Lines 1-3).

With respect to Claim 2, Bartle further teaches the gamma ray source comprises a ^{137}Cs or ^{60}Co or similar radioisotope source having an energy of substantially 1 MeV (Column 2, Lines 62-64).

With respect to Claim 3, Bartle further teaches the gamma ray source comprises an X-ray tube or electron accelerator producing X-rays through Bremsstrahlung on a target (Column 2, Lines 63-64).

With respect to Claim 4, Bartle further teaches that the neutron source produces neutrons having substantially higher energies than the gamma rays from the gamma ray

source (Column 5, Lines 64-66), where the neutron and gamma sources are arranged to pass through the same slot in the collimating block (Figure 2), and a detector array (5) is used, comprising individual pixels of plastic or liquid organic scintillator (Column 5, Lines 34-38), where discrimination between the gamma rays and the neutrons is made on the basis of the energy they deposit in the scintillator (Column 2, Lines 57-61).

With respect to Claim 15, Bartle further teaches that the computing means (25) comprises a computer (Column 5, Line 15) to perform image processing and display the images on a computer screen (Column 5, Lines 15-20).

With respect to Claim 17, Bartle further teaches that the mass-attenuation coefficient images are obtainable from count rates (I_n and I_γ) measured from the transmissions for each of the deuterium-tritium neutrons or deuterium-deuterium neutrons and gamma rays (Column 3 Lines 17-26, and Column 4 Lines 1-22).

With respect to Claim 18, Bartle further teaches that the computer (25) is operable to obtain cross section ratio images between pairs of mass attenuation coefficient images (Column 3, Lines 17-26).

With respect to Clam 20, Bartle further teaches that the computer (25) is able to perform automatic material identification based on the measured cross sections (Column 3 Lines 17-26 and 7-8, and Column 5 Lines 25-30).

With respect to Claim 22, Bartle further teaches that the sources and detector array are stationary (Figure 2 and Column 9 Lines 22-24) and a transport mechanism (15) is arranged such that the object is able to be moved in front of the source of neutrons (Figure 2 and Column 9 Lines 22-24).

With respect to Claim 24, Bartle further teaches that there are multiple sets of detectors (7) situated around the sources which are centrally located (Figure 2, and Column 5, Lines 1-7) to allow scans of a plurality of separate objects to be acquired simultaneously (Column 5, Lines 25-30).

With respect to Claim 26, Bartle further teaches the intensity of the deuterium-deuterium and/or deuterium-tritium neutron sources is as high as practically possible (Column 5, Lines 62-66).

Claims 1, 3, 7, 13, 15, and 17-21, as they are best understood, are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent to Gozani et al. (USP# 5,089,640).

With respect to Claim 1, Gozani et al. teach radiographic equipment comprising: a source (170) of substantially mono-energetic fast neutrons produced via the deuterium-tritium or deuterium-deuterium fusion reactions comprising a sealed-tube or similar generator for producing the neutrons (Column 14, Lines 15-24); a source of X-rays (152) of sufficient energy to substantially penetrate an object to be imaged (Column 12 Lines 42-47); a collimating block (136) surrounding the neutron and X-ray sources, apart from the provision of one or more slots for emitting substantially fan-shaped radiation beams (Column 13, Lines 55-63); a detector array (144, 146, 178-181, and Column 12 Lines 36-45) aligned with the fan-shaped beams emitted from the source collimator and collimated (182) to substantially prevent radiation other than that directly transmitted from the sources reaching the array (Column 14, Lines 31-59);

conversion means (Column 15, Lines 39-41) for converting light pulses produced in the scintillators into electrical signals (Column 15, Lines 39-45); conveying means (140) for conveying the object between the sources and the detector array (Column 12, Lines 32-47); computing means (154) for determining from the electrical signals the attenuation of the neutrons and the X-ray beams (Column 12, Lines 26-47, and Column 15 Lines 42-45) and to generate output representing the mass distribution and composition of the object interposed between the sources and detector array (Column 15 Lines 13-24, and Column 17 Lines 9-17); and display means (158) for displaying images based on the mass distribution and the composition of the object being scanned (Column 17 Lines 9-20).

With respect to Claim 3, Gozani et al. further teach the X-ray source comprises a conventional X-ray tube or electron accelerator producing X-rays through Bremsstrahlung on a target (Column 8 Lines 53-60).

With respect to Claim 7, Gozani et al. further teach each slot of the source and detector collimators (136, 182) are sufficiently wide to ensure full illumination of the detectors by the source, whilst minimizing the detection of scattered radiation (Column 13 Lines 48-68, and Abstract Lines 22-27).

With respect to Claim 13, Gozani et al. further teach that the electrical signals from the conversion means (Column 15, Lines 39-41) are used to infer the transmission of the neutrons from the neutron source and the X-rays or gamma rays through the object being scanned, or the transmission of the neutrons from the first neutron source,

the X-rays or gamma rays and neutrons from a second neutron source through the object being scanned.

With respect to Claim 15, Gozani et al. further teach that the computing means (154) comprises a computer (Column 13, Line 2) to perform image processing and display the images on a computer screen (158, and Column 15 Lines 13-18).

With respect to Claim 17, Gozani et al. further teach that the mass-attenuation coefficient images are obtainable from count rates measured from the transmissions for each of the deuterium-tritium neutrons or deuterium-deuterium neutrons and X-rays (Column 15 Lines 42-45 and Column 17 Lines 9-20).

With respect to Claim 18, Gozani et al. further teach that the computer (154) is operable to obtain cross section ratio images between pairs of mass attenuation coefficient images (Column 13 Lines 16-19, Column 15 Lines 59-68, Column 16 Lines 1-11, and Column 17 Lines 11-17).

With respect to Claims 19 and 21, Gozani et al. further teach that the proportions in which the cross section images are combined are operator adjustable to maximize contrast and sensitivity to a particular object being examined in the image (Column 13, Lines 11-31, and Column 17 Lines 9-20).

With respect to Clam 20, Gozani et al. further teach that the computer (154) is able to perform automatic material identification based on the measured cross sections (Column 20 Lines 19-39, and Column 21 Lines 28-38).

Claims 1, 2, 22, 24, and 26, as they are best understood, are rejected under 35 U.S.C. 102(b) as being anticipated by U.S. Patent to Sowerby (USP# 4,314,155).

With respect to Claim 1, Sowerby teaches radiographic equipment comprising: a source (1) of substantially mono-energetic fast neutrons produced via the deuterium-tritium or deuterium-deuterium fusion reactions (Column 5, Lines 53-64), comprising a sealed-tube or similar generator for producing the neutrons (Figure 1); a source (9) of gamma rays of sufficient energy to substantially penetrate an object (11) to be imaged (Column 5, Lines 30-45); a collimating block surrounding the neutron and X-ray/Gamma ray sources, apart from the provision of one or more slots for emitting substantially fan-shaped radiation beams (Column 4 Lines 51-59, and Column 3 Lines 60-66); a detector array (7) aligned with the fan-shaped beams emitted from the source collimator and collimated (6, 8, 15) to substantially prevent radiation other than directly transmitted from the sources reaching the array (Column 5, Lines 20-27); conversion means for converting light pulses produced in the scintillators into electrical signals (Column 5, Lines 65-68, Column 6 Lines 1-2 & 62-68); conveying means (24) for conveying the object between the sources and the detector array (Column 6, Lines 56-61); computing means (30) for determining from the electrical signals the attenuation of the neutrons and the X-ray or gamma ray beams and to generate output representing the mass distribution and composition of the object interposed between the sources and detector array(Column 6 Lines 62-68, Column 7 Lines 1-2, and Column 3 Lines 20-26); and display means for displaying images based on the mass distribution and the

composition of the object being scanned (Figures 3-6, Column 6 Lines 1-2 & 62-68, and Column 7 Lines 1-2).

With respect to Claim 2, Sowerby further teaches the X-ray or gamma ray source comprises a ^{60}Co or similar radioisotope source having an energy of substantially 1 MeV (Column 5, Lines 60-64).

With respect to Claim 22, Sowerby further teaches that the sources (1, 9) and detector array (7) are stationary and a transport mechanism (24) is arranged such that the object (11) is able to be moved in front of the source of neutrons (Figure 7, and Column 6 Lines 56-61).

With respect to Claim 24, Sowerby further teaches that there are multiple sets of detectors (7) situated around the sources (1, 9) which are centrally located to allow scans of a plurality of separate objects to be acquired simultaneously (Figure 7, Column 6 Lines 56-61, and Column 8 Lines 22-27).

With respect to Claim 26, Sowerby further teaches the intensity of the deuterium-deuterium and/or deuterium-tritium neutron sources is as high as practically possible (Column 5, Lines 53-60).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

Claims 5 and 6 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gozani et al., as for Claim 1 above, and in view of U.S. Patent to Armistead (USP# 5,838,759).

With respect to Claim 5, Gozani teaches most of the elements of the claimed invention, including a collimating block (136) for the sources and a detector array (144, 146, 178-181), but does not teach that sources are arranged to pass through the same slot in the collimating block, that a single detector array is used, comprising individual pixels of plastic or liquid scintillator, wherein discrimination between the X-rays/gamma rays and neutrons is made on the basis of the energy they deposit in the scintillator.

Armistead teaches radiographic equipment for inspection of objects with x-rays and neutrons, with an x-ray source (14), a neutron source (12), and a single detector array (18) with liquid or plastic scintillator material (Column 6, Lines 3-20) for fast recovery of detector after x-ray flash (Column 3, Lines 45-49), wherein discrimination between the x-rays and neutrons slowed before striking detector is made on the basis of the energy they deposit in the scintillator (Column 5 Lines 60-67, and Column 6 Lines 1-20) with a reduction in parts and cost over separate detectors (Column 3, Lines 45-58), wherein the sources are combined by use of a converter plate (22) so that each will pass through the same slot in a collimator (16, Figure 1), providing a reduction in cost and parts over providing separate sources (Column 3, Lines 50-58).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the combined neutron and x-ray source, collimator, and detector of

Armistead in the apparatus of Gozani et al. to provide a compact system with fewer parts and less expensive to make.

With respect to Claim 6, Gozani et al. further teach the sources are arranged to pass through separate parallel slots of the collimating block (Column 13, Lines 55-63), and two detector arrays are used, one for neutrons and one for x-rays, but do not teach that detector arrays comprise plastic or liquid scintillator pixels.

Armistead teaches radiographic equipment for inspection of objects with x-rays and neutrons, with an x-ray source (14), a neutron source (12), and a detector array (18) with liquid or plastic scintillator material (Column 6, Lines 3-20) for fast recovery of detector after x-ray flash (Column 3, Lines 45-49), wherein discrimination between the x-rays and neutrons slowed before striking detector is made on the basis of the energy they deposit in the scintillator (Column 5 Lines 60-67, and Column 6 Lines 1-20).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the plastic/liquid scintillator of Armistead to provide quick detector recovery after use.

Claims 11, 13, and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bartle, as for Claim 1 above, and in view of U.S. Patent to Armistead (USP# 5,838,759).

With respect to Claim 11, Bartle teaches most of the elements of the claimed invention including conversion means and scintillator material, but does not teach that the conversion means comprises a plurality of photodiodes, wherein the scintillator

material is selectable to have an emission wavelength substantially matched to the response of the photodiodes

Armistead teaches radiographic equipment for inspection of objects with x-rays and neutrons, with an x-ray source (14), a neutron source (12), and a detector array (18) with liquid or plastic scintillator material (Column 6, Lines 3-20), with conversion means comprising a plurality of photodiodes with good operator range and detector-to-detector matching (Column 4, Lines 61-65), wherein the scintillator material is selectable to have an emission wavelength substantially matched to the response of the photodiodes (Column 4 Lines 45-67, and Column 6 Lines 3-20) to provide detectors that are either inexpensive or with improved resolution for the type of radiation and application used (Column 6, Lines 3-20).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the scintillator material and photodiodes of Armistead in the apparatus of Bartle to provide detectors with better image quality and less background interference for the types of radiation incident upon them and the desired applications.

With respect to Claim 13, Bartle further teaches that the electrical signals from the conversion means (21) are used to infer the transmission of the neutrons from the neutron source and the gamma rays through the object being scanned (Column 5, Lines 1-20).

With respect to Claim 23, Bartle teaches most of the elements of the claimed invention, including the source and the detector array arranged on either side of the object (Figure 2) and a transport mechanism (15), but does not teach that the transport

mechanism is arranged so that source and detector array move in synchronicity on either side of the object.

Armistead teaches radiographic equipment for inspection of objects with x-rays and neutrons, with an x-ray source (14), a neutron source (12), a detector array (18), and a transport mechanism (38) for an object (12) to be inspected, wherein the source, detector, and transport mechanism are arranged so that source and detector array move in synchronicity on either side of the object (Column 8, Lines 55-60) to inspect large containers or vehicles that are difficult to move during inspection (Column 7 Lines 48-50, and Column 8 Lines 9-11).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the source and detector movement and transport arrangement of Armistead in the apparatus of Bartle, for the purpose of inspecting vehicles, or other large, heavy cargo.

Claims 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bartle, as for Claim 1 above, and in view of U.S. Patent to Givens (USP# 4,066,892).

With respect to Claims 8-10, Bartle teaches most of the claimed invention, including collimated detector arrays using plastic or liquid scintillator material (Column 5, Lines 34-38), and neutron sources using either the deuterium-deuterium or deuterium-tritium fusion reactions (Column 2 Lines 30-31, and Column 5 Lines 64-67), and a neutron source of substantially 2.45 MeV (Column 5, Lines 64-66), but does not teach a second neutron source producing neutrons, neutrons of an energy of substantially 14

MeV, and wherein the second source uses the complimentary fusion reaction to the first neutron source, and wherein neutrons from the second neutron source are detected in a separate detector array.

Givens teach radiographic imaging equipment for material identification wherein a first (11, 12) and a second source of neutrons of differing energy are used (Abstract, and Figure 1), wherein the second source uses the complimentary fusion reaction to the first neutron source (Column 2, Lines 32-59), each with its own separate detector array (13, 14), to provide energy discrimination for selectively identifying specific elements or materials in objects inspected (Column 1 Lines 50-68, Column 2 Lines 1-10, and Column 3 Lines 35-37).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the second neutron source and detector of Givens in the apparatus of Bartle, to provide the identity of materials identified in objects via energy discrimination.

Further with respect to Claim 10, although Givens teaches different energies for the sources, he does not specifically teach that the second source energy is substantially 14 MeV. Givens does teach that the selection of neutron energies is based upon the type of material to be identified (Column 3 Lines 27-37, and Column 4 Lines 10-18).

It would have been obvious to one having ordinary skill in the art at the time the invention was made to set neutron energies at the optimum range for the material that is being looked for, since it has been held that discovering an optimum value of a result effective variable involves only routine skill in the art. *In re Boesch, 617 F.2d 272, 205*

USPQ 215 (CCPA 1980). Additionally, Examiner notes that applicant does not place any criticality on the values of 2.45 MeV and 14 MeV, using them as exemplary only in Lines 9-14 on Page 7 of the specification, and it appears that the invention would work equally well with other energies according to the chosen application of the system.

Claim 12 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bartle, as for Claim 1 above, and in view of U.S. Patent Application Publication to Katagiri (PGPUB# 2002/0121604).

With respect to Claim 12, Bartle teaches most of the claimed invention, including conversion means and a multiplicity of single or multi-anode photomultiplier tubes (Column 5 Lines 39-40), but does not teach that conversion means comprises crossed wavelength shifting fibers coupled to the photomultiplier tubes.

Katagiri teaches radiographic imaging equipment with a neutron/gamma ray detector array (Paragraph 47) having conversion means of crossed wavelength shifting fibers (Paragraphs 5 and 10) to enable multi-functional radiation imaging (Paragraph 10) in a detector that is easier and less expensive to make than mounting several small scintillators (Paragraph 5).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the wavelength shifting fibers of Katagiri in the apparatus of Bartle, to enable multi-functional radiation imaging in a detector that is easy and inexpensive to produce.

Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bartle and Armistead, as for Claim 13 above, and in view of U.S. Patent to Walterman (USP# 6,061,469).

With respect to Claim 14, Bartle and Armistead teach most of the elements of the claimed invention, including using transmissions of radiation to compute mass attenuation coefficient images for each pixel, and an image based on these computations (Bartle, Column 3 Lines 1-26, and Column 4 Lines 7-22), but do not teach that different pixels values are mapped to different colors.

Walterman teaches imaging equipment wherein images obtained from radiation attenuated by an object are created with pixels mapped to different shades based on the mass attenuation of materials imaged (Flow Chart, Figure 3A) to allow fast visual identification of material in the image by the operator (Abstract).

It would have been obvious to one of ordinary skill in the art to use the shaded images of Walterman in the apparatus of Bartle and Armistead, to allow fast and easy identification of material by a human operator. Although Walterman teaches shades of black and white, it known to use colors to distinguish differences in images with the unaided human eye rather than shades of gray.

Claims 16, 19, and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Bartle, as for Claims 1, 13, and 15 above, and in view of U.S. Patent to Walterman (USP# 6,061,469).

With respect to Claim 16, Bartle teaches most of the elements of the claimed invention, including output that is convertible to mass-attenuation coefficient images for each pixel for display on a computer screen, but does not teach that different pixel values are mapped to different colors.

Walterman teaches imaging equipment wherein images obtained from radiation attenuated by an object are created with pixels mapped to different shades based on the mass attenuation of materials imaged (Flow Chart, Figure 3A) to allow fast visual identification of material in the image by the operator (Abstract).

It would have been obvious to one of ordinary skill in the art to use the shaded images of Walterman in the apparatus of Bartle, to allow fast and easy identification of material by a human operator. Although Walterman teaches shades of black and white, it known to use colors to distinguish differences in images with the unaided human eye rather than shades of gray.

With respect to Claim 19, Bartle further teaches cross section ratio images are combined, but does not teach that proportions of said images are operator adjustable to maximize contrast and sensitivity to a particular object being examined in the image.

Walterman teaches combined images wherein proportions of said images are operator adjustable (Column 5, Lines 1-21) to maximize contrast and sensitivity to a particular object being examined in the image (Column 5, Lines 16-19) and to help instruct operators in analyzing the images (Column 5, Lines 19-21).

It would have been obvious to one of ordinary skill in the art to use the operator adjustable images of Walterman in the apparatus of Bartle, to improve identification of objects in images by human operators.

Claim 25 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bartle, as for Claim 1 above, and in view of Armistead and U.S. Patent to Eberhard et al. (USP# 5,905,806).

With respect to Claim 25, Bartle teaches most of the claimed invention, including obtaining multiple views, but does not teach that views are obtained by either rotating the object relative to the sources and the detector array or by rotating the sources and detector array relative to the object.

Armistead teaches radiographic equipment for inspection of objects with x-rays and neutrons, with an x-ray source (14), a neutron source (12), and a single detector array (18) with liquid or plastic scintillator material (Column 6, Lines 3-20) for fast recovery of detector after x-ray flash (Column 3, Lines 45-49), wherein discrimination between the x-rays and neutrons slowed before striking detector is made on the basis of the energy they deposit in the scintillator (Column 5 Lines 60-67, and Column 6 Lines 1-20) with a reduction in parts and cost over separate detectors (Column 3, Lines 45-58), wherein the sources are combined by use of a converter plate (22) so that each will pass through the same slot in a collimator (16, Figure 1), providing a reduction in cost and parts over providing separate sources (Column 3, Lines 50-58).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the combined neutron and x-ray source, collimator, and detector of Armistead in the apparatus of Bartle to provide a compact system with fewer parts and less expensive to make.

Eberhard et al. teach radiographic imaging equipment wherein a source of X-ray radiation is used to image an object with a detector array (Column 2, Lines 61-62), wherein multiple views are obtained by rotating the source and detector array relative to the object using a gantry (100) so that bag content are not shifted (Column 3, Lines 28-33), to provide a three-dimensional density map of the object (Column 3, Lines 11-26) to determine if the object requires further screening by a neutron source (Column 2, Lines 61-65).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the gantry rotation of Eberhard et al. in the apparatus of Bartle and Armistead, to provide pre-screening of possible fragile, personal items in luggage without requiring possibly damaging object movement, and without the need for additional time and expense of neutron analysis of every package.

Claim 27 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bartle, as for Claim 1 above, and in view of U.S. Patent Application Publication to Homme et al. (PGPUB# 2003/0116715).

With respect to Claim 27, Bartle teaches most of the claimed invention, including scintillators, but does not teach that scintillators are surrounded by a mask to cover at

least a portion of each of the scintillators, each mask having a first reflective surface to reflect escaped light pulses back into the scintillator.

Homme et al. teach radiographic imaging equipment with a detector array (100) having scintillators (3), wherein scintillators are surrounded by a mask (52) to cover at least a portion of each of the scintillators (Figure 3), each mask having a first reflective surface to reflect escaped light pulses back into the scintillator (Paragraph 24) thereby increasing detection sensitivity (Paragraph 24).

It would have been obvious to one of ordinary skill in the art at the time of the invention to use the reflective mask of Homme et al. in the apparatus of Bartle, to increase the sensitivity of the detector for improved imaging.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

U.S. Patents to: Mohr et al. (USP# 5,519,225) regarding neutron/gamma ray radiographic equipment with detectors having many pixels, conversion means, computing means, and pixel mapping; Bartko (USP# 3,832,545) regarding liquid/plastic scintillation detectors for gamma ray inspection equipment; Tang et al. (USP# 5,481,584) regarding radiographic inspection images based on mass attenuation coefficients; Kuswa et al. (USP# 4,675,145) regarding single sources of both neutrons and gamma rays in sealed tubes; Loomis et al. (USP# RE 36,012) regarding plural

detectors for a neutron source, and Kallmann (USP# 2,297,416) regarding simultaneous or gated generation of neutrons and x-rays for inspection equipment.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anastasia Midkiff whose telephone number is 571-272-5053. The examiner can normally be reached on M-F 7-4.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on 571-272-2490. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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